

REMARKS

Applicants have amended their claims in order to facilitate proceedings in connection with the above-identified application, and so as to clarify and simplify issues in connection therewith. Specifically, the non-elected claims, claims 35-40 and 45-50, have been cancelled without prejudice or disclaimer, and in particular, without prejudice to the filing of a Divisional application directed to the subject matter thereof. In light of cancelling of the non-elected claims, it is respectfully submitted that the restriction requirement on page 2 of the Office Action mailed October 23, 2006, is moot. In any event, in order to avoid any question as to completeness of this response, Applicants affirm their election of the Group I claims.

The comments by the Examiner in connection with the Information Disclosure Statement filed April 26, 2006, in the last paragraph on page 2 of the Office Action mailed October 23, 2006, are respectfully traversed. As seen in the enclosed postcard receipt for the Information Disclosure Statement filed on April 26, 2006, a copy of the Korean Official Action, as well as four (4) references, were received in the U.S. Patent and Trademark Office (USPTO). Moreover, as set forth in this Information Disclosure Statement filed April 26, 2006, an English translation of the Korean Official Action was submitted. In view thereof, it is respectfully submitted that all documents of the Information Disclosure Statement indicated as submitted April 26, 2006, were submitted, such that this Information Disclosure Statement must be considered by the Examiner.

As indicated in the Form PTO/SB/08A enclosed with the Information Disclosure Statement submitted April 26, 2006, the Abstracts only of EP 0957664 and WO 97/47165 were submitted; these Abstracts only were submitted as being English-language Abstracts of the submitted Korean patent document, i.e.,

KR 2000—0016429.

It is emphasized that complete copies of EP 0957664 and WO 97/47165 were not submitted as part of the Information Disclosure Statement filed April 26, 2006. Accordingly, and contrary to the contention by the Examiner in the last paragraph on page 2 of the Office Action mailed October 23, 2006, it is respectfully submitted that legible copies of each cited document was submitted. In view of the foregoing, it is respectfully requested that the Examiner reconsider the position taken in the first paragraph of Item 3, on page 2 of the Office Action mailed October 23, 2006, and consider each and every one of the documents submitted with the Information Disclosure Statement filed April 26, 2006, indicating such consideration by initialing a copy of the submitted Form PTO/SB/08A and B. If copies of the documents in the Information Disclosure Statement filed April 26, 2006, are not in the USPTO record, the Examiner is respectfully requested to contact the undersigned to obtain additional copies, for consideration; and, if necessary, the Examiner is requested to contact the undersigned for an additional copy of the Form PTO/SB/08A and B submitted with the Information Disclosure Statement filed April 26, 2007.

The requirement by the Examiner for Applicants to submit a copy of foreign patent documents EP 0957664 and WO 97/47165 "as listed on the PTOL 1449 filed on April 26, 2006", is noted. Copies of these documents "as listed on the PTOL 1449" were submitted, that is, "Abstract only" of each was submitted. In any event, in order to comply with the requirement by the Examiner, enclosed herewith please find a full copy of each of EP 0957664 and of WO 97/47165.

The comment by the Examiner in the second paragraph on page 3 of the Office Action mailed October 23, 2006, is noted. The records of the undersigned do

not reflect submission of the foreign patent documents listed in the second paragraph on page 3 of this Office Action mailed October 23, 2006. The Examiner is requested to indicate when such foreign patent documents were submitted according to the records of the USPTO.

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended each of claims 1 and 16, the independent claims being considered on the merits in the above-identified application, to recite that the insulating resin composition layer contains any one of cyanate resin, polyphenylene ether resin, polyamidoimide resin and epoxy resin, and a latent curing agent, as principal ingredient; to recite that the surface treatment is an anti-corrosive treatment, a chromate treatment and silane coupling treatment; and to recite that a thickness of the metal foil is not more than 3 μ m. In light of amendments to claims 1 and 16, claims 3, 5, 8, 9, 12, 14, 18, 20, 23, 24, 27 and 29 have been cancelled without prejudice or disclaimer; and dependencies of various of the other previously considered claims have been amended, in view of the aforementioned cancelling of claims.

Furthermore, Applicants are adding new claims 51-54 to the application. Claims 51 and 52, each dependent on claim 2, recite that the surface roughness of the metal foil is not more than 1.5 μ m in both the surfaces, and is not more than 1.0 μ m in both the surfaces, respectively. Note, for example, page 20 of Applicants' specification. Claims 53 and 54, dependent respectively on claims 1 and 16, recite that the metal foil is a copper foil.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed

October 23, 2006, that is, the teachings of U.S. Patent No. 6,132,589 to Ameen, et al., and European Patent Document No. 1006763 to Fujiwara, et al., under the provisions of 35 USC 102 and 35 USC 103.

Initially, it is noted that the subject matter of, inter alia, claim 3 and claim 18 has been respectively incorporated into claims 1 and 16. Noting that claims 3 and 18 were not rejected under 35 USC 102 in Items 5 and 6 on pages 3 and 4 of the Office Action mailed October 23, 2006, it is respectfully submitted that these anticipation rejections are moot.

As for the rejection set forth in Item 7 on page 5 of the Office Action mailed October 23, 2006, it is respectfully submitted that the teachings of Ameen, et al. or Fujiwara, et al. would not have suggested the presently claimed invention.

Specifically, it is respectfully submitted that the teachings of the applied references do not disclose, nor would have suggested, such resin coated metal foil, or such metal clad laminate, as in the present claims, wherein the insulating resin composition layer contains a resin as set forth in claims 1 and 16, together with the metal foil, and wherein a thickness of the metal foil is not more than 3µm. Note claims 1 and 16.

Moreover, it is respectfully submitted that these references would have neither taught nor would have suggested such resin coated metal foil, or such metal clad laminate, as in the present claims, having features as discussed previously in connection with claims 1 and 16, and, moreover, wherein the insulating resin composition layer contains cyanate resin, with the anti-corrosion treatment being performed with a metal mainly containing nickel. See claim 7; note also claim 22.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such resin

coated metal foil or such metal clad laminate as in the present claims, having features as discussed previously in connection with claims 1 and 16, and, moreover, the surface roughness of the metal foil as in claims 2, 17, 51 and 52, or the interfacial roughness between the insulating resin composition layer and the metal foil as in claims 4 and 19; and/or the anti-corrosive treatment as in claims 6 and 21; and/or wherein the silane coupling agent chemically reacts with the insulating resin composition by heating (note claims 10 and 25); and/or wherein the insulating resin composition contains epoxy resin and the silane coupling agent contains amino functional silane (see claims 11 and 26); and/or wherein the insulating resin composition contains epoxy resin which is liquid at room temperature (see claims 13 and 28); and/or relative dielectric constant or dielectric loss tangent of the post-cure insulating resin composition as in claims 15 and 30; and/or wherein the metal foil is a copper foil (see claims 53 and 54) and/or the printed wiring board produced, as in claims 31 and 41, and having a peel strength as in claims 33, 34, 43 and 44.

As being claimed in the above-identified application, the present invention relates to a resin coated metal foil and metal clad laminate, particularly suitable for printed wiring boards, and the printed wiring boards produced.

Recently, as demand for miniaturization, weight reduction and speeding-up of electronic equipment has increased, density growth of the printed wiring board has been investigated, particularly using a semi-additive process, the semi-additive process allows finer wiring to be formed. However, various problems arise in connection with circuit formation on a resin coated metal foil by the semi-additive process, including adherence of the metal foil to the resin. While it has previously been proposed to provide a roughened layer having a thickness of several micrometers for obtaining a given peel strength between the metal foil and a resin

cured material, this obstructs thinning of the metal foil. Moreover, due to the irregularity of the roughened surface, there can disadvantageously be generated an etching residue, which causes a short-circuit failure, and electric resistance of a conductor circuit of the roughened layer increases so that transmission loss becomes larger.

While it has been proposed to utilize a copper foil in which the roughening treatment is not performed, utilizing a peroxide curing resin composition, under this approach it becomes necessary to use a peroxide curing resin as the insulating layer, but there is a fear that reliability of the printed wiring board manufactured with the copper clad laminate including the peroxide curing resin decreases. Moreover, as the peroxide curing resin itself is a potentially hazardous material, and has a greater cost than previously proposed insulating resins, use of the peroxide curing resin is not practical.

Against this background, Applicants provide a metal clad laminate and resin coated metal foil having good adhesion and which can be provided and used at relatively low cost and which can be easily handled. Applicants have found that by utilizing a resin as in the present claims, together with the metal foil which has been subjected to an anti-corrosive surface treatment, a chromate treatment and a silane coupling treatment, and wherein the thickness of the metal foil is not more than $3\mu\text{m}$, objectives according to the present invention are achieved. In particular, by providing a laminate/metal clad foil wherein the foil has a thickness of not more than $3\mu\text{m}$, treated as mentioned previously, with an insulating resin composition layer as discussed previously, the structure is excellent not only in adhesion of insulating resin layer and metal (e.g., copper) foil, but also in good wiring formability. In particular, as described in the sole full paragraph on page 21 of Applicants'

specification, by providing the metal foil of thickness of not more than 3 μm , good wiring formability is achieved.

In addition, and as set forth in claims 7 and 22, when cyanate resin is used as a resin to be contained in the insulating resin composition layer, and Ni treatment is applied as the anti-corrosive treatment, it is possible to obtain a resin coated metal foil and metal clad laminate extremely excellent in aspects including adhesion of insulating resin layer and foil, adhesion after heating and adhesion after PCT (pressure cooker test).

Ameen, et al. discloses a treated copper foil, having a layer of zinc oxide adhered to a base surface of at least one side of the copper foil, the layer of zinc oxide having a thickness of about 3 Å to about 80 Å, and a layer of a trivalent chromium oxide adhered to the layer of zinc oxide. This patent further discloses, in one embodiment, that the foil has a layer of a silane coupling agent adhered to the layer of trivalent chromium oxide. See column 2, lines 15-22. Note also column 2, lines 52-63; column 3, lines 1-6; column 4, lines 55-62; column 5, lines 19 and 20; and column 6, lines 47-50.

Fujiwara, et al. discloses a copper foil for making printed circuit boards, the copper foil comprising a copper layer, an alloy layer (A) comprising copper, zinc, tin and nickel which is formed on a surface of copper foil, and a chromate layer which is formed on a surface of the alloy layer, the surface to be laminated with a substrate for a printed wiring board. This patent document discloses that the copper foil may further have a silane coupling agent layer on a surface of the chromate layer. Note especially paragraphs [0016] – [0018] on page 3 of this patent document. Note also paragraphs [0026] – [0035] on page 4; and paragraphs [0043] – [0046] on page 5.

As recognized by the Examiner in the second paragraph of Item 7, on page 5

of the Office Action mailed October 23, 2006, neither of the applied references discloses the thickness of the copper foil. Particularly in view of the advantages achieved by the present invention with metal foil thicknesses as in the present claims, as indicated previously, it is respectfully submitted that Ameen, et al. and Fujiwara, et al. would have neither disclosed nor would have suggested the presently claimed invention, including metal (copper) foil thickness, particularly in view of the following. That is, note that Ameen, et al., in column 2, lines 43 and 44, discloses that the copper foils typically have nominal thicknesses ranging from about 0.0002 inch to about 0.02 inch. It is respectfully submitted that this thickness is about 5-500 μ m, greater than the thickness as in the present claims; and it is respectfully submitted that Ameen, et al. would have taught away from the presently claimed subject matter, including thickness of the metal foil, and advantages thereof.

Note that in Example 1 in columns 11 and 12 of Ameen, et al., this patent document discloses a copper foil sample having a weight of 1oz/ft², which is probably about 40 μ m, further teaching away from the presently claimed subject matter.

Fujiwara, et al. mentions use of copper foil of a thickness of 35 μ m in Example 1 on page 8, also teaching away from the relatively small thickness metal foil of the present claims. In view of the advantages achieved through use of the relatively small thickness metal foil as in the present claims, it is respectfully submitted that the presently claimed subject matter patentably distinguishes over the teachings of the applied documents.

In the third paragraph on page 5 of the Office Action mailed October 23, 2006, the Examiner contends that it would have been obvious to choose, inter alia, a "thickness for the copper foil because [this variable] can be obtained by rolling

process". The fact that a process may have been known for producing such a thickness does not provide guidance for forming a layer of such thickness.

Particularly in view of the teachings in each of the applied references of a much greater thickness, and advantages achieved by the present invention having such relatively small thickness, it is respectfully submitted that the applied references do not disclose, nor would have suggested, the foil thickness as in the present claims.

Applicants respectfully traverse the provisional obviousness-type double patenting rejections, as set forth in Items 8 and 9 on pages 5 and 6 of the Office Action mailed October 23, 2006.

Initially, it is noted that the claims of the various applications, which are copending, can be amended, the double patenting rejection; being a provisional rejection, and it is respectfully submitted that these provisional rejections should be held in abeyance until fixing of claims.

In any event, note that all of the present claims recite a thickness of the metal foil, and also recite that the metal foil has been subjected to surface treatment which is an anti-corrosive treatment, a chromate treatment and a silane coupling treatment. It is respectfully submitted that the claimed subject matter of the applications being applied in the provisional obviousness-type double patenting rejection do not set forth a surface which has been treated, inter alia, by a chromate treatment, and do not recite a thickness of the metal foil being not more than 3 μ m. Moreover, it is respectfully submitted that the claims of No. 10/986,913 do not recite any surface treatment, while claims of No. 11/044,533 individually recite a rust preventing treatment or a silane coupling treatment. Clearly, even as claims stand presently amended, it is respectfully submitted that the claims of No. 10/986,913 and of No. 11/044,533 would have neither taught nor would have suggested the presently

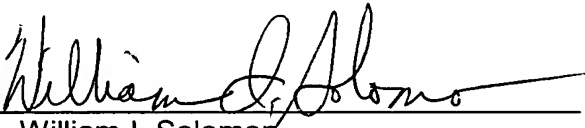
claimed subject matter.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application, are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 1204.44255X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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Enclosures

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Patent Dkt. No. 1204.44255X00 Attorney Initials WIS/ksh
Application No. 10/506,529 Filing Date 01/31/2005
Applicant(s) K. TAKAI, et al.
Papers Filed Herewith on 04/26/2006

Receipt is hereby acknowledged of the papers filed as indicated by the checked items in connection with the above-identified application:

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